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S5200D-TX

DIGITAL TRANSMISSION TEST TRANSMITTER

PRELIMINARY MANUAL
Form 0160-0681B

tau-tron

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Important:

In order not to delay shipment of your instrument we have provided a preliminary manual. Although incomplete, this manual does provide sufficient information for you to understand and operate the instrument.

To receive a final manual please complete, detach, and mail the lower card.

If you would like a representative to call, require additional information, or would like to be placed on our mail list to receive **The Pulse** or other useful technical information, please complete, detach, and mail the card below.

Please —

☐ Have representative call.

☐ Add me to your mail list.

Send additional information on:

☐ Bit Error Rate Test Equipment
☐ Data/Word Generators
☐ Data Loggers
☐ High-Speed Components

My general application is _____

Name _____ Title _____

Company _____ Dept./MS _____

Address _____ City _____

State&Zip _____ Phone _____

Form 148A-0581C

Send final manual for:

Model(s) _____

Serial Number(s) | | | | | | | | |

to:

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Form 148B-0581C

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SCOPE

This manual provides operation and basic diagnostic information for the Tau-Tron S5200D Digital Transmission Test Transmitter.

DESCRIPTION

The Tau-Tron S5200D Digital Transmission Test Transmitter together with its companion instrument, the S5200D Digital Transmission Test Receiver, form a compact test set for detailed measurements of systems operating at the DS3 transmission rate.

Basic measurements include bit and parity total errors, error rate, and error seconds, and total bipolar violations plus 24 additional records for fault analysis monitoring and statistical data. The set works with test signals or live traffic, framed or unframed, and manually or completely automatically.

WARRANTY

All Tau-Tron products are warranted against any defects in material and workmanship. This warranty applies for one year from the date of delivery for all Tau-Tron manufactured products. The warranty period for OEM products sold by Tau-Tron will depend on the original OEM warranty (consult factory for specific products). We will repair or replace products which, upon our examination, prove to be defective during the warranty period.

NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING FITNESS FOR PURPOSE, MECHANTABILITY OR OTHERWISE, IS GIVEN.

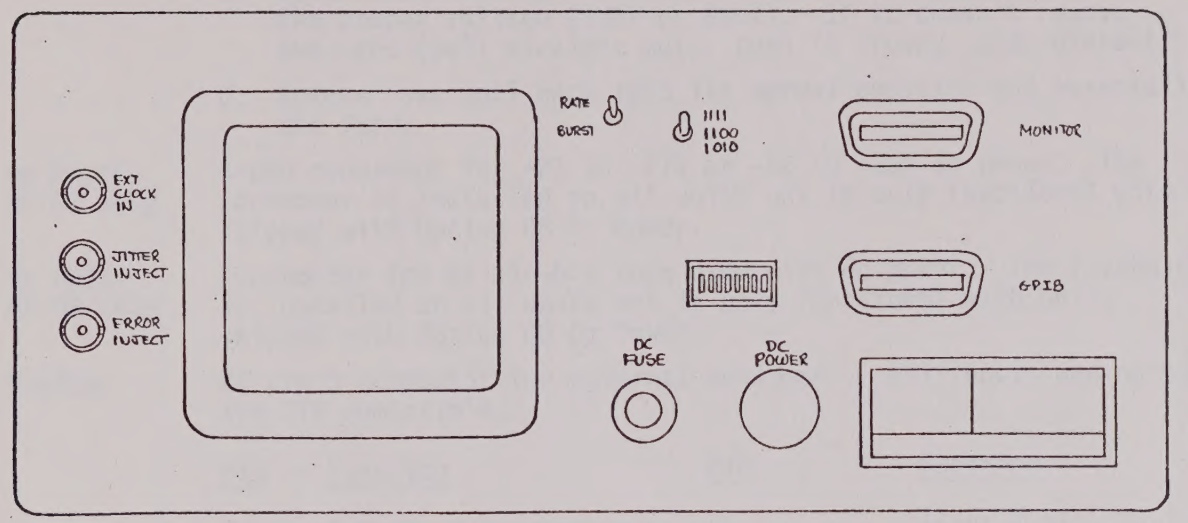
For any assistance, contact Customer Service with details of the instrument model, serial numbers, and malfunction, see Repair Returns below.

SHIPPING DAMAGE

If any signs of damage are noted on the outside of the carton, request the carrier's agent to be present during unpacking. If external damage is found on the instrument follow Repair Returns procedure below.

Check our the electrical performance of the instrument as soon as possible after receipt. If any malfunctions are observed, follow Repair Return procedure below.

REAR PANEL



EXT CLOCK IN	Input BNC connector for external clock of 44.736MHz ±5% at ECL compatible level into 75Ω , ac coupled. When external clock input exceeds 800mV p-to-p, transmitter automatically switches to external clock.
JITTER INJECT	Information on use to be provided at a later time.
ERROR INJECT RATE-BURST	Input BNC connector for external error-inject signal, TTL compatible. Works in conjunction with RATE-BURST switch. IN RATE: Error is introduced at each positive-going transition at rates from 4 to 450K errors/s, 220ns min pulse width. IN BURST: 100% errors are generated during the time the input is high.
Ac Power	Three-wire connector accepts the 6-foot power cord supplied. Before connection, check that the proper line voltage range (120V or 240V) is selected and proper fuse is installed:

a. Open cover door and rotate fuse pull to left.

b. Remove fuse and check that it is 2A slo-blo.

c. Check that the legend on the PC card in the connector reads the proper voltage (120V or 240V). If it doesn't remove the card (pull straight out), turn it around, and reinsert.

d. Rotate fuse pull back into its normal position and reinstall the fuse.

Dc Power
OP-08 only

4-pin connector for -21 to -27V or -42 to -56V dc power. The connector is installed on all units but is only functional with units shipped with Option 08 Dc Power.

Dc FUSE
OP-08 only

Fuseholder for 6A slo-blo fuse used with dc power. The fuseholder is installed on all units but is only functional with units shipped with Option 08 Dc Power.

Monitor

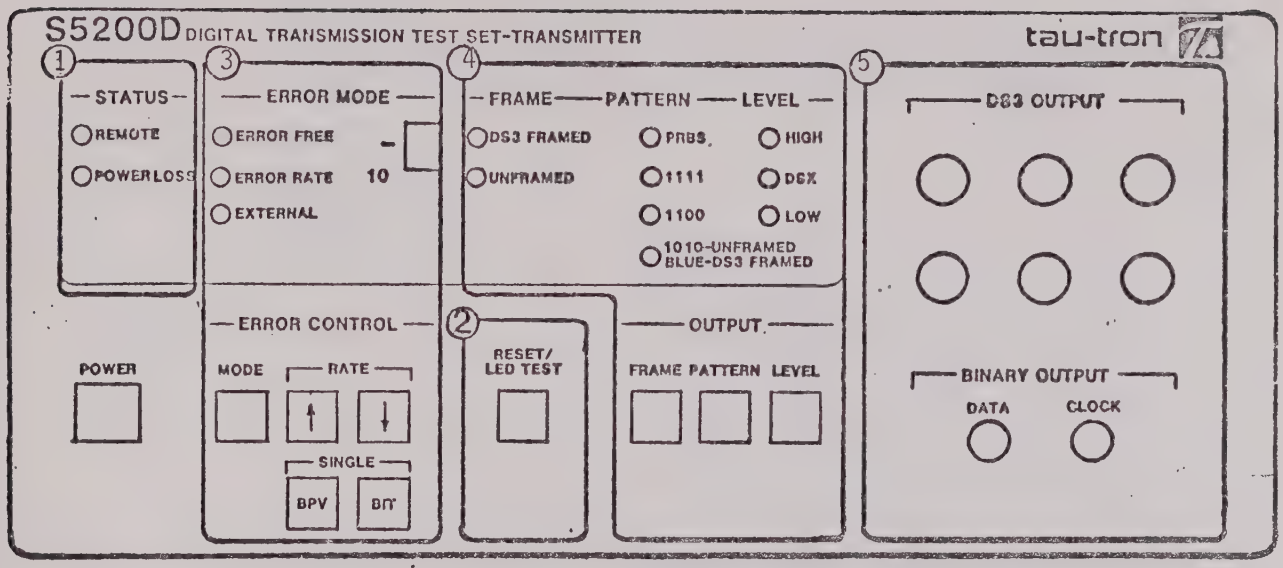
24-pin D connector for external equipment. All inputs and outputs are TTL compatible.

Pin	Function	Pin	Function
7	Output, M Sync pulse	21	Input,X-bit, lo-level
18	Output, M Sync pulse'		Sets X-bit low: hi-level
17	Output, PR Sync pulse		or no connection sets
5	Output, PR Sync pulse'		X-bit high
10	Output, Lost power	11,12,14	Ground
22	Output, Lost power'	23,24	

GPIB
OP-02 only

20-pin D Connector for use with external controller. The connector is installed on all units but is only functional on units shipped with Option 02-IEEE-488 Interface. Details are provided with the option.

FRONT PANEL



Multi-selection pushbuttons — Several pushbuttons are multi-selection; that is, each time they are pushed they select a different operating characteristic and then return to the initial characteristic in the sequence. For example, by repetitively pushing the MODE button, you can select error free, internal error injection, or external error inject modes. Pushing the MODE button after the last choice (external error inject) has been selected will return the mode to the first choice in the sequence (error free).

Indicator lights — Green....Normal condition
Yellow...Special condition
Red.....Alarm

Group 1 Status

Indicator	Meaning	Notes
Indicator signifies status of remote control input	REMOTE	REMOTE yellow indicator singifies unit is under remote control by IEEE 488 or RS-232 input applied to rear-panel connector.
Indicator signifies status of ac power.	POWER LOSS	POWER LOSS yellow indicator signifies ac power input was lost for some time during test.

Group 2 Test

Control	Selection	
RESET/TEST	Reset AC POWER LED, test indicators	PUSH to reset AC POWER LED and to light all front-panel indicators.

Group 3 Error Injection

Control	Selection	
MODE	Error free	ERROR FREE green indicator light.
	Error rate	ERROR RATE yellow indicator light.
(RATE ↑) (RATE ↓)		Push RATE ↑ to increase error rate, RATE↓ to decrease it; as indicated on display from 10^{-2} thru 10^{-9}. Display is dim in Error-free mode to indicate the rate that would be selected in Error-rate mode; display is bright in Error-rate mode.
	External	EXTERNAL yellow indicator light. Apply signal to ERROR INJECT rear-panel BNC connector.
SINGLE BPV	Single bipolar error	Push SINGLE BPV to inject a single bipolar error in Error-free mode.
SINGLE BIT	Single bit error	Push SINGLE BIT to inject a single bit error in Error-free mode.

Group 4 Output Selection

Control	Selection	
FRAME	DS3 framed	DS3 FRAMED green indicator light. If parity tests are to be made, output must be set for framed signal.
	Unframed	UNFRAMED yellow indicator light.
PATTERN	Pseudorandom	PRBS green indicator light.
	All one's Alternating 1100 Alternating 10	1111,1100,1010 yellow indicator light; depending on setting of rear-panel toggle switch.
LEVEL	High	HIGH yellow indicator light.
	DSX	DSX green indicator light.
	Low	LOW yellow indicator light.

Group 5 Output Connection

DS3	Connect 75 Ω cable from any of the DS3 OUTPUT WeCo 358 connectors to system under test.
Binary data only	Connect 75 Ω cable from Binary Output DATA BNC connector to system under test.
Binary data with clock	Connect 75 Ω cables from Binary Output DATA and CLOCK BNC connector to system under test.

TRANSMITTER PERFORMANCE VERIFICATION

These tests can be made with the S5200D transmitter alone to provide a partial check on its operation. They also provide an introduction to the operation and capabilities of the unit.

More thorough checks, particularly of the output circuits, require an S5200D receiver. These checks are included in the next section "Set Performance Verification".

Transmitter Power Up

Turn on transmitter POWER. Yellow POWER LOSS STATUS indicator will light.

Push and hold RESET/LED TEST. All STATUS, ERROR MODE, FRAME, PATTERN, and LEVEL indicators will light.

Release RESET/LED TEST. Yellow POWER LOSS STATUS indicator will extinguish (no STATUS indicator will be lit) and only one ERROR MODE, FRAME, PATTERN, and LEVEL indicator will be lit.

Repetitively push the ERROR CONTROL MODE button. ERROR MODE indicators (ERROR FREE, ERROR RATE, and EXTERNAL) will light one at a time. Leave at point where yellow ERROR RATE 10^{-X} is lit (X is numeric indicator which brightens in ERROR RATE mode).

Repetitively push the ↓ button. ERROR RATE numeric indicator number will increase by one for each push up to -9. Repetitively push ↑ button. ERROR RATE numeric indicator will decrease by one for each push down to -2. Leave at -5 and set MODE to ERROR FREE.

Repetitively push the OUTPUT FRAME button. FRAME indicators (DS3 FRAMED and UNFRAMED) should light one at a time. Leave at DS3 FRAMED.

Set rear-panel Short Word switch up to 1111 and repetitively push the OUTPUT PATTERN button. PATTERN indicators (PRBS and 1111) will light one at a time.

Set rear-panel Short Word switch to the center 1100 position and repetitively push the OUTPUT PATTERN button. PATTERN indicator (PRBS and 1100) will light one at a time.

Set rear-panel Short Word switch down to 1010 and repetitively push the OUTPUT PATTERN button. PATTERN indicators (PRBS and 1010) will light one at a time Leave the rear-panel Short Word switch down at 1010 and the PATTERN at PRBS.

Repetitively push the OUTPUT LEVEL button. LEVEL indicators (HIGH, DSX, and LOW) will light one at a time. Leave at DSX.

Turn POWER off then back on. The following indicators will light (indicating last control settings have been remembered):

STATUS.....POWER LOSS
ERROR MODE....ERROR FREE
FRAME.....DS3
PATTERN.....PRBS
LEVEL.....DSX

Push RESET/LED TEST to extinguish POWER LOSS indicator.

SET PERFORMANCE VERIFICATION

These tests must be made with an S5200D transmitter and, together with the "Receiver Performance Verification" test of the previous section, provide a comprehensive check of the receiver operations.

These tests are the same as those in the transmitter manual.

Receiver Status Indicators

Transmitter settings:

ERROR MODE....ERROR FREE	(Push ERROR CONTROL MODE button for ERROR FREE indication).
FRAME.....DS3 FRAMED	(Push OUTPUT FRAME button for DS3 FRAMED indication)
PATTERN.....PRBS	(Push OUTPUT PATTERN button for PRBS indication).
LEVEL.....DSX	(Push OUTPUT LEVEL button for DSX indication).

Receiver settings:

TIME MODE.....UNTIMED
FRAME.....DS3 FRAMED
PATTERN.....PRBS
LEVEL.....DSX

Connect transmitter DS3 OUTPUT to receiver DS3 INPUT and push receiver START/RESET button. None of the receiver STATUS indicators will be lit.

Disconnect input to receiver. The following receiver STATUS indicators will light:

STATUS.....red SIGNAL yellow
red DS3 FRAME yellow yellow X-BIT
red DATA SYNC yellow

Repetitively push the receiver INPUT LEVEL button. LEVEL indicators (DSX, HIGH/LOW , BINARY DATA & CLK, and BINARY DATA ONLY) will light one at a time and STATUS indicators will remain lit.

Reconnect signal to receiver DS3 INPUT. The following STATUS indicators will light:

STATUS..... SIGNAL yellow
DS3 FRAME yellow
DATA SYNC yellow

Push START/RESET button. All STATUS indicators will extinguish.

Push transmitter OUTPUT PATTERN button to select BLUE signal (transmitter rear-panel Short Word switch must be down to 1010). The following receiver STATUS indicators will light.

STATUS.....red DATA SYNC yellow
Yellow BLUE yellow

Push transmitter OUTPUT PATTERN button to select PRBS. The following receiver STATUS indicators will light:

STATUS..... DATA SYNC yellow
BLUE yellow

Push receiver START/RESET button. All STATUS indicators will extinguish.

Measurements

Transmitter settings:

ERROR MODE....ERROR RATE 10^{-5} (Push ERROR CONTROL MODE button for ERROR RATE, push RATE ↓ or ↑ for 10^{-5}).

FRAME.....Leave at DS3 FRAMED
PATTERN.....Leave at PRBS
LEVEL.....Leave at DSX

Receiver settings:

TIME MODE.....SINGLE, 10 seconds (Push TIME MODE for SINGLE MODE? display push YES button, push 1 button then 0 button for 10-second test, and push ENTER button).

BASIC DISPLAY-PAR RATE, TOT PAR (If left display does not read PAR ERR RATE=---, push BASIC DISPLAY RATE until it does. If right display does not read TOT PAR ER=---, push BASIC DISPLAY TOTAL button until it does).

FRAME.....Leave at DS3 FRAMED
PATTERN.....Leave at PRBS
LEVEL.....Leave at DSX

Leave transmitter DS3 OUTPUT connected to receiver DS3 INPUT.

Push receiver START/RESET button to initiate test. At the end of 10 seconds, red TIME MODE STOP/END indicator will light (indicating the end of the 10-second test) and display should read:

PAR ERR RATE = 1.0E-05 TOT PAR ER= 4421(±3 counts)

Push receiver BASIC DISPLAY RATE button. Display will read:

BIT ERR RATE=1.0E-05

Push BASIC DISPLAY TOTAL button. Display will read:

TOT BIT ER= 4421(±3 counts)

Push TOTAL button again. Display will read:

TOT BPV ER=0

Push transmitter OUTPUT LEVEL button for LOW level and push receiver INPUT LEVEL button for HIGH/LOW level.

Push receiver START/RESET TO INITIATE A 10 SECOND TEST. Midway through test push STOP/PAUSE button. Red TEST STOP/END indicator will light.

Push CONTINUE button. Green TEST IN PROCESS will light. At end of test red TEST STOP/END indicators will light. Push BASIC DISPLAY RATE button for BIT ERR RATE on display and push TOTAL button for TOT BIT ER on display. Display will read:

PAR ERR RATE=1.0E=05 TOT BIT ER=4421 (±3counts).

Push transmitter ERROR CONTROL MODE button for ERROR FREE mode then push receiver START/RESET button to initiate a 10-second test. During test push transmitter SINGLE BPV error button twice, waiting at least 1 second between pushes. At end of test push receiver TEST CATG button for BPV FUNCTIONS? then push YES button. Display will read:

AVG BPV ERR RATE=4.5E-09 00-00:00:10

Repetitively push TEST FUNCTION button. Display will read:

AVG BPV ERR RATE = 4.5E-09 00-00:00:10
% BPV ERR FREE SEC=80.0000 00-00:00:10
BPV ERR SEC =2 TOT BIT ER= 0

Push receiver START/RESET button to initiate a 10-second test. Push transmitter OUTPUT FRAME button twice rapidly to change from DS3 FRAMED to UNFRAMED back to FRAMED and push OUTPUT PATTERN button twice rapidly to change from PRBS to BLUE back to PRBS. Push TEST CATG button for STATUS FUNCTIONS? then push YES button. Display will read:

Sig Loss SEC =0

Repetitively push TEST FUNCTION button. Display will read:

FramLoss SEC = 1 (or 2)
Sync Loss SEC= 2 (or 3)
Blue Sig SEC = 1 (or 2)
X-Bit SEC = 1 (or 2)
Extrnl A SEC = 0
Extrnl B SEC = 0
Extrnl C SEC = 0
Extrnl D SEC = 0

Audio Alarm

Transmitter settings:

ERROR MODE....Leave at ERROR FREE
FRAME.....Leave at DS3 FRAMED
PATTERN.....Leave at PRBS
LEVEL.....DSX (Push OUTPUT LEVEL button for DSX level).

Receiver settings:

TIME MODE Leave at UNTIMED
BASIC DISPLAY BIT RATE, TOT BIT (Push BASIC DISPLAY RATE button for BIT ERR RATE display and push BASIC DISPLAY TOTAL button for TOT BIT ER).

FRAME.....Leave at DS3 FRAMED
PATTERN.....Leave at PRBS
LEVEL.....Leave at DSX

Leave transmitter DS3 OUTPUT connected to receiver DS3 INPUT.

Turn up receiver VOLUME control, push START/RESET button to initiate a test, and push transmitter ERROR CONTROL SINGLE BIT error button. Receiver audio alarm will beep each time bit error is introduced and TOT BIT ER display will advance one count.

Push transmitter ERROR CONTROL MODE for ERROR RATE mode and push ↓ RATE button to increase rate (decrease exponent). Audio alarm tone will indrease in frequency. Push ↑ RATE button to decrease rate. Audio alarm tone will decrease in frequency. At 8 tone will beep about once every 2 seconds. At 9, tone will beep about once every 22 seconds. Push transmitter ERROR CONTROL MODE to return to ERROR FREE.

Push TEST CATG button to select ALARM FUNCTIONS?, then push YES button. Display will read:

DO YOU WANT SigLoss ALARM? YES or NO

Push YES button and disconnect cable from transmitter DS3 OUTPUT. Audio alarm will sound. Reconnect cable to a different DS3 OUTPUT connect. Alarm will silence. Check each output connector in this manner. Leave cable connected to one DS3 OUTPUT.

Push TEST CATG button to select ALARM FUNCTIONS then push YES button. Push TEST FUNCTION button to select frame loss. Display will read:

DO YOU WANT FramLoss ALARM? YES or NO

Push YES button and push transmitter OUTPUT FRAME button to select UNFRAMED. Audio alarm will sound. Push OUTPUT FRAME button to return to DS3 FRAMED. Alarm will silence.

Push TEST CATG button to select ALARM FUNCTIONS then push YES button. Push TEST FUNCTION button to select blue signal. Display will read:

DO YOU WANT Blue Sig ALARM? YES or NO

Push YES button and push transmitter OUTPUT PATTERN button to select BLUE. Audio alarm will sound. Push OUTPUT FRAME button to return to PRBS. Alarm will silence.

Short Patterns

Transmitter settings:

ERROR MODE....Leave at ERROR FREE
FRAME.....Leave at DS3 FRAMED
PATTERN.....Leave at PRBS
LEVEL.....Leave at DSX

Receiver settings:

TIME MODE Leave at UNTIMED
BASIC DISPLAY BIT RATE, TOT BIT (Push BASIC DISPLAY RATE button for BIT ERR RATE display and push BASIC DISPLAY TOTAL button for TOT BIT ER).

FRAME.....Leave at DS3 FRAMED
PATTERN.....Leave at PRBS
LEVEL.....Leave at DSX

Leave transmitter DS3 OUTPUT connected to receiver DS3 INPUT.

Set both the transmitter and receiver rear-panel Short Word switches to the center 1100 position. Push the transmitter OUTPUT PATTERN button for an 1100 pattern. Push the receiver INPUT PATTERN button for an 1100 pattern, and push the receiver START/RESET button. No receiver STATUS indicatorswill be lit.

Push the transmitter ERROR CONTROL SINGLE BIT button. The TOT BIT ER display will accumulate a count each time button is pushed.

Set both the transmitter and receiver rear-panel Short Word switches up to 1111. Push the receiver START/RESET button. No receiver STATUS indicators be lit.

Push the transmitter ERROR CONTROL SINGLE BIT button. The TOT BIT ER display will accumulate a count each time button is pushed.

Binary Signals

Transmitter settings:

ERROR MODE....Leave at ERROR FREE
FRAME.....Leave at DS3 FRAMED
PATTERN.....Leave at PRBS
LEVEL.....Leave at DSX

Receiver settings:

TIME MODE.....Leave at UNTIMED
BASIC DISPLAY.Leave at BIT RATE, TOT BIT (Push INPUT LEVEL button for BINARY
FRAME.....Leave at DS3 FRAMED DATA & CLK indication).
PATTERN.....Leave at PRBS
LEVEL.....BINARY DATA & CLK (Push INPUT LEVEL button for BINARY DATA & CLK indication).

Disconnect transmitter DS3 OUTPUT from receiver DS3 INPUT. Connect a 75Ω BNC cable from the transmitter BINARY OUTPUT DATA to the Receiver BINARY DATA. Connect a 75Ω BNC cable from the transmitter BINARY OUTPUT CLOCK to the receiver BINARY CLOCK.

Push receiver START/RESET button. No receiver STATUS indication will be lit.

Push transmitter ERROR CONTROL SINGLE BIT button. The TOT BIT ER display will accumulate a count each time button is pushed.

Disconnect transmitter BINARY OUTPUT CLOCK from receiver BINARY CLOCK. Push receiver INPUT LEVEL button for BINARY DATA ONLY indication and push START/RESET button. No receiver STATUS indiactors will be lit.

Push the transmitter ERROR CONTROL SINGLE BIT button. The TOT BIT ER display will accumulate a count each time button is pushed.

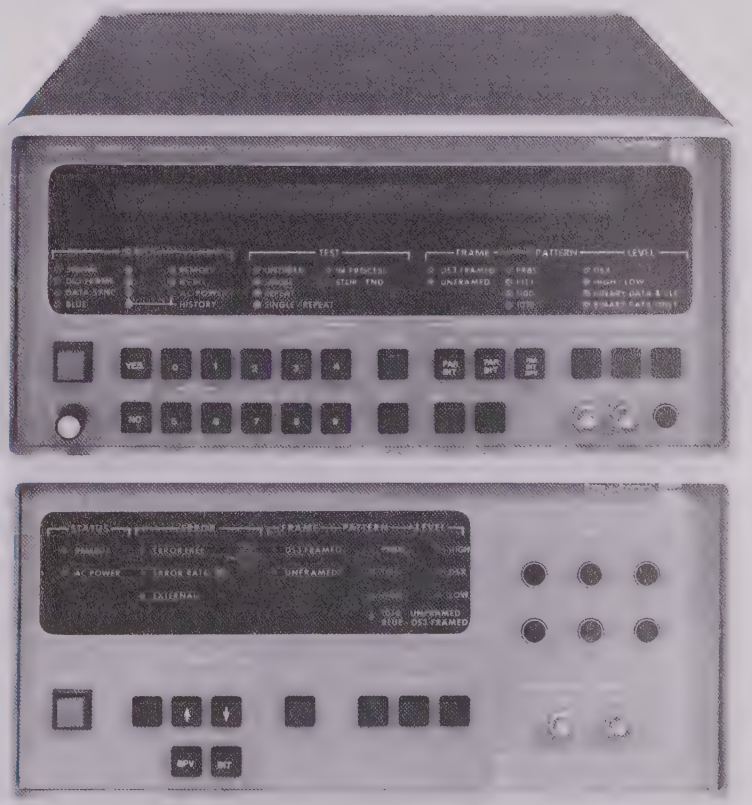
END

tau-tron

S5200D

Digital Transmission Test Set

- More than 30 simultaneous measurements for system performance tests and characterization, fault analysis, monitoring, and statistical data
- Real-time information for correlation studies
- Pseudorandom data sequence and selection of short patterns with or without DS3 framing for testing versatility
- Bipolar and binary-signal I/O testing, with or without clock
- Four different timing modes increases versatility
- Blue-signal generation, detection, and alarm
- Internal and external error injection in continuous or burst modes
- Extra-sensitive receiver works with greater than 26dB attenuation
- Easily read 40-character alpha-numeric display plus status indicators provide complete measurement data
- Optional RS-232-C output allows automatic, hard-copy records
- Microprocessor-based monitoring and analysis
- Ac and optional dc input power capability



For complete, Automatic Characterization of DS3 Transmission Systems

The Tau-Tron S5200D Digital Transmission Test Set is a compact test set for simple, yet flexible, measurements of systems operating at the DS3 transmission rate. It provides an unsurpassed degree of confidence in data collection and analysis for a wide variety of applications including commissioning, routine maintenance, troubleshooting, long-term monitoring and production testing of fiber optics, digital radio, digital multiplexers, protection switches, and cable systems.

Flexible Sophistication

The S5200D's sophisticated microprocessor-based technology provides a wide range of capabilities to characterize any common system and a few uncommon ones. Measurements and computations include the number of bit errors, parity violations, bipolar violations, bit and parity synchronous error-seconds, bit and parity error rates and average error rate, percent of error-free seconds, and tests for bit, parity, bipolar code, status, and alarm conditions. All measurements and computations are performed simultaneously.

A choice of test patterns allows a great deal of testing flexibility. A pseudorandom sequence of 32,767 bits, all ones, alternating 1100, and alternating 10, can all be generated. The all ones pattern without framing is a useful standard for calibrating signal levels. The unframed alternating 1100 and 10 patterns are useful for troubleshooting because they can be traced easily through a radio or fiber system and will be self-synchronizing on an oscilloscope. The alternating 10 pattern, when properly framed with the standard DS3 framing pattern, constitutes the "blue signal" to test the transmission system alarm circuitry. The test set

receiver automatically decodes this signal and provides both a front-panel indicator and rear-panel alarm signal output. Error injection can be manually controlled from 1 x 10^{-2} to 1 x 10^{-9} or externally controlled at continuous rates of from 4 to 450,000 errors per second or as bursts with variable duty cycles of error-free and error-conditioned signals to test systems stressed by various error conditions.

Exclusive Capabilities

The set operates not only with the standard B3ZS signal but with binary data and clock signals as well to adapt it to applications where B3ZS coding is not used. Operation with or without an external clock input is also possible over a wide input frequency range because of the frequency/phased-locked timing recovery loop tailored to communication system requirements.

Because of its high sensitivity and wide input dynamic range, the S5200D is guaranteed to work at levels much higher than normal, and at levels attenuated by more than 26dB below the DSX cross connect point. Input response has also been designed to permit operation up to 450 feet downstream from the cross-connect point.

The S5200D is the only set of its kind that can generate the standard DS3-compatible 32,767-bit pseudorandom sequence with or without DS3 framing. The absence of framing allows measurements of switching-time faults in radio systems and the number of errors generated during a switch, and allows testing of satellite systems using unframed signals at the DS3 rate. Use of a pseudorandom sync pulse on both the transmitter and receiver permits measurements of variations in transit time in satellite patterns.

Also unique to the S5200D is its ability to define the nature of transmission impairment through the introduction of threshold error-second and dribbling-error measurements. These measurements quantify the magnitude of the errors and thus aid in any steps taken to reduce or eliminate them.

A new DS3 framing algorithm and fast-feed-forward data sync technique allows the set to acquire lock faster than other instrumentation and minimizes loss of sync in high-error-rate environments. This also allows measurements of reframe time in multiplexers, and allows investigations of the effects surrounding diversity and protection switches.

Complete, Concise Answers

A versatile, 40-character alpha-numeric display with large, easily read characters provides all data for the some 40 records the S5200D is capable of producing - from total bit errors to time of day.

The display, together with front-panel status indicators, are arranged so that multiple characteristics can be displayed simultaneously for analysis. The combinations are all under total operator control.

Automatic, Unattended Operation

Long-term testing proceeds automatically and unattended because of several carefully considered design advantages - dc operation from office batteries in the event of an ac power failure, automatic circuits that measure the seconds the signals is lost, the frame is lost, data sync is lost, a blue signal is detected, and an X-bit is detected, and four external inputs that allow system or site parameters, such as alarms, to be logged in terms of seconds active during the test.

An audio output, with volume control, can be set to activate as a function of error rate, signal loss, frame loss, and blue-signal detection. This audible indication enables very fine system adjustments to be made in situations where the operator cannot see the test-set display.

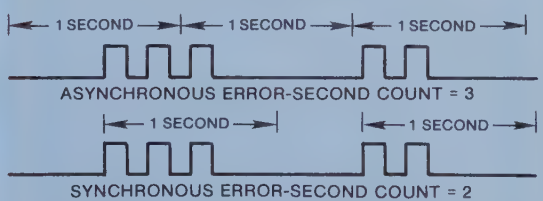
Equally important in many applications is an optional RS232 interface that permits connection of a printer to record all related events pertaining to each error-second, together with a periodic summary of important measured results, including the actual number of errors during the second, status information, etc.

Correlation Aids Trouble Analysis

Internal and external events can be correlated to error activity which greatly enhances the sets' ability to analyze complex problems. For example, the total parity errors can be measured while monitoring up to four external events and then correlating the activity of these parameters against the number of DS3 frame-losses or signal losses that may occur.

A Note About Error-Second Measurements

Two types of error-second measurements are in general use, asynchronous and synchronous.

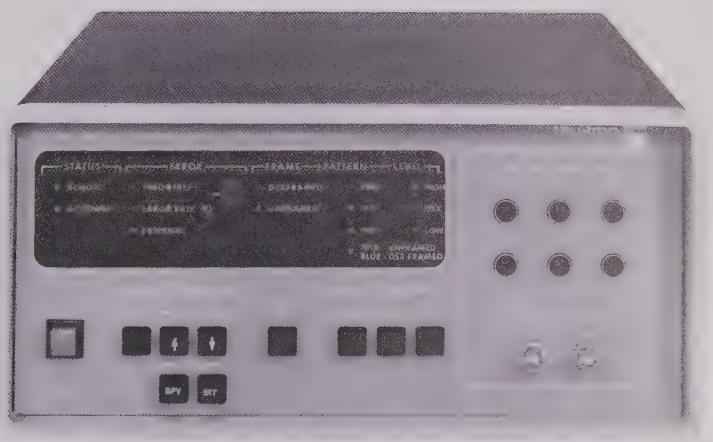


With asynchronous measurements, contiguous one-second measurements are made starting at some time independent of the errors. Any error or errors occurring during any one-second interval registers as an error-second. With synchronous measurements, the one-second measurements are triggered by the errors.

Synchronous errored-second measurements always give the lowest possible count and always give consistent counts - two test sets making the same measurement will always read the same. For these reasons they are preferred by industry and are the type used by Tau-Tron.

Everything you ever wanted to know about your DS3 Transmission Path but never had a system that could measure it all at one time, in one place, and at the push of a button, or two!

- Total Bit Errors
- Total Parity Errors
- Total Bipolar Violations
- Bit Error-Seconds
- Parity Error-Seconds
- Bit Error Rate
- Parity Error Rate
- Percent Bit Error-Free Seconds
- Percent Parity Error-Free Seconds
- Average Bit-Error Rate For Test Duration
- Average Parity-Error Rate For Test Duration
- Time of Day
- Time into Measurement
- Time Remaining in Measurement
- Bit Dribbling Error Rate
- Bit Dribbling Total Errors
- Bit Error-Seconds Where Rate Exceeds 10^{-3}
- Bit Error-Seconds Where Rate Exceeds 10^{-4}
- Bit Error-Seconds Where Rate Exceeds 10^{-5}
- Bit Error-Seconds Where Rate Exceeds 10^{-6}
- Parity Dribbling Error Rate
- Parity Dribbling Total Errors
- Parity Error-Seconds Where Rate Exceeds 10^{-4}
- Parity Error-Seconds Where Rate Exceeds 10^{-5}
- Parity Error-Seconds Where Rate Exceeds 10^{-6}
- Bipolar Error Rate
- Average Bipolar-Error Rate For Test Duration
- Percent Bipolar Error-Free Seconds
- Bipolar Error Seconds
- Number of Seconds During Which Lost Signal Was Detected
- Number of Seconds During Which Lost Frame Was Detected
- Number of Seconds During Which Lost Data Sync Was Detected
- Number of Seconds During Which X-Bit Was Detected
- Number of Seconds During Which Blue-Signal Was Detected
- Number of Seconds During Which Any of Four Different External Inputs Were Detected



TRANSMITTER SPECIFICATIONS (S5200D TX)

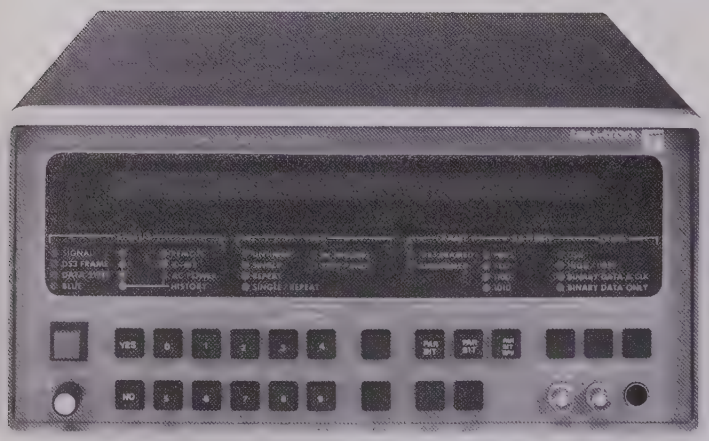
Clock: Clock can be internal, external, or externally jitter modulated. ***INTERNAL:*** 44.736MHz with stability of ±20ppm from 0 to 50°C. ***EXTERNAL:*** 44.736MHz ±5% at ECL compatible level into 75Ω ac coupled, applied to rear-panel BNC connector. When external clock input exceeds 800mV p-to-p, transmitter automatically switches to external clock.

Data Patterns: Pattern and frame information indicated by front-panel LED's. ***PSEUDORANDOM:*** 2^{15} –1 = 32,767 bit words, self-starting. ***SHORT WORDS:*** All one's (1111. . .), alternating 1100 (11001100. . .), and alternating 10(1010. . .). Alternating 10 pattern, when properly framed with the standard DS3 framing pattern constitutes a "blue signal". A logic–1 always follows each framing and control bit. ***FRAMED:*** Output is selected data pattern with standard Bell System DS3 frame and control bits added. ***UNFRAMED:*** Output is selected data pattern without any framing or control bits.

Status Monitor: A rear-panel 24-pin D connector provides normal and complemented TTL-compatible outputs for the pseudorandom data sync pulse, DS3 M-sync pulse, and ac power fail. An X-bit input is also provided.

Error-Rate Injection: Bit or bipolar violations are injected into the output signal. Parity is computed on the data pattern prior to bit-error injections so parity errors will usually be generated. Bit errors or bipolar violations may occur in the framing as well as the data content. Bipolar violations are restricted to not occur in a B3ZS substitution, nor will they violate the B3ZS coding format so that bipolar error insertions will not cause bit errors. ***INTERNAL:*** 10^{-2} thru 10^{-9} bit-error insertion rate for integer values of the exponent; controlled by front-panel pushbuttons and indicated on front-panel readout. Single-bit or bipolar error inserted each time front-panel pushbutton is depressed. ***EXTERNAL:*** Applied to rear-panel BNC connector, TTL compatible, at rates from 4 to 450k errors/s, 220ns min pulse width. Allows any bit-error rate from 10^{-2} to 10^{-7}, as well as error bursts, to be transmitted, as set by rear-panel switch. Single bit-error injected each time input exceeds threshold thus causing transmitted bit-error rate to be a function of the input frequency in continuous mode. Burst errors (100%) are generated during the time the input exceeds threshold in burst mode.

Output: Outputs are DS3 and binary data and clock.



DS3: Available at 6 front-panel WECO 358 connectors with B3ZS code (bipolar three-zero substitution) at rate of 44.736MHz, 11.2 ±1.1ns pulse at half amplitude, with 4.5 ±1.5ns transition times. High level is 0.91V pk ±1 dB, DSX level includes insertion loss of 450 ft. of R/G728A cable, and low level of 13.8 ±1 dB below high-level (0.186V pk ±1 dB) level is indicated on front-panel LED's. ***BINARY DATA:*** Available at front-panel BNC connector as binary NRZ with logic-1 of +1V and logic-0 of -1V with 75Ω source impedance (other levels available, consult factory). ***BINARY CLOCK:*** Available at front-panel BNC connector as square-wave with logic-1 of +1V and logic-0 of -1V with 75Ω source impedance (other levels available, consult factory).

Power: 115V or 220V ±10%, 50 to 60 Hz, 60VA, via a 6-foot detachable power cord (supplied) that connects to a rear-panel receptacle and is stored in the cover when not in use. A front-panel LOST POWER LED indicator lights following restoration of power after a low-line or power-fail condition; indicator can be reset by front-panel pushbutton. Dc power available, see Option 08.

Mechanical: Portable bench-top blue-painted aluminum case with protective cover. Convenient carrying handle mounted on right side of case. ***DIMENSIONS:*** 6.6 in. high x 13.6 in. wide, x 19.82 in. deep overall including cover and handle. ***WEIGHT:*** 19 lbs. net, 24 lbs. shipping.

Accessories Supplied: Ac power cord, protective cover, instruction manual, and spare fuse.

Option 01 Special Output Characteristics: Binary data and clock output levels, other than +1V for logic-1 and -1V for logic-0 behind 75Ω at BNC connectors can be provided; consult factory.

Option 02 IEEE-488 Interface: For remote control.

Option 08 Dc Power: -21 to -27V or -42 to -56Vdc, 90VA, office-battery input, via a 6-foot detachable power cord (supplied) that connects to a rear-panel receptacle, separately fused.

RECEIVER SPECIFICATIONS
(S5200D RX)

Input: Input can be DS3 at DSX or high/low-level or binary data with or without clock; input type indicated by front-panel LEDs. ***DS3:*** Applied to front-panel WECO 358 connector at rates up to 44.736MHz; 75Ω input with return loss >20dB from 1 to 50 MHz. High/low range is 1.6V pk, 0.91V nominal for high signal; 13.8dB below high for low signals; 11.2 ±1.1ns pulse at half amplitude, with 4.5 ±1.5ns transition times and <10% overshoot/undershoot. DSX level includes insertion loss of a cable equalizer that equalizes 450 to 900 ft. of R/G728A cable. Low level sensitivity sufficient for insertion losses >26dB. ***BINARY DATA*** input is binary NRZ of 500mV p-to-p amplitude, OV threshold, 75Ω (other levels available, consult factory). ***BINARY CLOCK*** input is squarewave of 500mV p-to-p amplitude, OV threshold, 75Ω (other levels available, consult factory).

Data Patterns: ***PSEUDORANDOM:*** $2^{15}-1$ = 32,767 bits per word. ***SHORT WORDS:*** All one's (1111...), alternating 1100 (11001100...), alternating 10 (1010...). Alternating 10 pattern, when properly framed with the standard DS3 framing pattern, constitutes a "blue signal".

Error Determination: ***BIT ERROR:*** Framed or unframed. Inequality between received data pattern and receiver's internally generated data pattern. ***PARITY ERROR:*** Framed only. Inequality between the parity bit calculated from live-traffic data bits or test-pattern data bits with the actual received parity bit in its usual position in the next frame. ***BIPOLAR ERROR:*** Framed or unframed. Bipolar violations detected on live traffic or test patterns.

Timing Modes: One of four timing modes can be pushbutton selected, a front-panel LED indicates the mode in use: ***UNTIMED:*** (Default, power-up mode). Continuous indication of accumulated errors and elapsed time. ***SINGLE:*** Errors are accumulated over a period of time from 1 second to 99 days as selected by front-panel pushbuttons. ***REPEAT:*** Same as Single except at the end of each test time the results are cleared and a new test is started; data displayed is from last test completed. ***SINGLE/REPEAT:*** A combination of Single and Repeat where the single duration time is longer than the repeat time; data displayed is from last test completed. Useful for long-term tests or any test where data would be printed automatically over a long-term period.

Basic Error Measurements: These measurements can be made in any of the four timing modes (above). ***TOTAL:*** Bit and parity errors and bipolar violations are measured simultaneously; displayed separately. ***ERROR SEC:*** Bit and parity errors are

measured simultaneously; displayed separately. ***ERROR RATE:*** Bit and parity errors are measured simultaneously; displayed separately. Timebase is 10^8 bits (approx. 2.2s) in Untimed or Single mode, operator selected in Repeat mode or Single/Repeat Mode. ***AVERAGE BIT ERROR RATE:*** Total error count divided by total bits accumulated since start of test (last Reset); displayed as long as associated front-panel pushbutton is depressed. ***PERCENT ERROR FREE SEC:*** Percent of error-free seconds since start of test (last Reset); displayed as long as associated pushbutton is depressed.

Auxiliary Measurements: These measurements can be made in any one of the four timing modes (above). ***BIT DRIBBLING ERROR RATE:*** The bit error rate that remains after subtraction of all errors during error seconds where the error rate was greater than 1×10^{-6}. ***TOTAL DRIBBLING BIT ERRORS:*** Total number of bit errors that remain after subtraction of all errors during error seconds where the error rate was greater than 1×10^{-6}. ***BIT THRESHOLD ERROR SECONDS:*** Bit error rate that exceeds threshold of 10^{-3}, 10^{-4}, 10^{-5}, and 10^{-6}; measured simultaneously and selected individually for display by front-panel pushbuttons. ***PARITY DRIBBLING ERROR RATE:*** The parity error rate that remains after subtraction of all errors during error seconds where the error rate was greater than 1×10^{-6}. ***TOTAL DRIBBLING PARITY ERRORS:*** Total number of parity errors that remain after subtraction of all errors during error seconds where the error rate was greater than 1×10^{-6}. ***PARITY THRESHOLD ERROR SECONDS:*** Parity error rate that exceeds thresholds of 10^{-4}, 10^{-5}, and 10^{-6}; measured simultaneously and selected individually for display by front-panel pushbuttons. ***BIPOLAR ERROR RATE, ERROR SECONDS, AVERAGE ERROR RATE, and PERCENT ERROR-FREE SECONDS.***

Clock: Built-in real-time clocks are used for time of day, time-into-test, time-remaining-in-test, and time of all status and alarm conditions; any of which can be displayed on the display, as selected by the operator. Time can be set by front-panel pushbuttons.

Display: 40-character high-brightness alpha-numeric with 0.235-in. high 5 x 7 dot-matrix characters. Full display used for operator prompting when setting initial measurement conditions; divided into a right and left field for simultaneous indication of two measured values, user selected, both with appropriate user-oriented names for unambiguous readouts.

Simultaneous Displays

Left Field	Right Field
Basic Error Measurements: Bit error-seconds (7 digits plus overflow), parity error-seconds (7 digits plus overflow), bit error rate (2 digits with 2-digit exponent).	**Basic Error Measurements:** Total bit errors (9 digits plus overflow), total parity errors (9 digits plus overflow), total bipolar violations (9 digits plus overflow).
Basic Error Measurements: Percent bit error-free seconds (7 digits), Percent parity error-free seconds (7 digits), total bit errors/total bits (2 digits with 2-digit exponent), total parity errors/total bits (2 digits with 2-digit exponent).	**Clock:** Time into measurement up to 99 days, 23 hours, 59 minutes, 59 seconds.
Auxiliary Measurements: Bit dribbling error rate (2 digits with 2-digit exponent), total bit dribbling errors (7 digits plus overflow), bit threshold error seconds with thresholds of 10^{-3}, 10^{-4}, 10^{-5}, or 10^{-6} (7 digits plus overflow), parity dribbling error rate (2 digits with 2-digit exponent), total parity dribbling errors (7 digits plus overflow), parity threshold error seconds with thresholds of 10^{-4}, 10^{-5}, or 10^{-6} (7 digits plus overflow), bipolar error rate (2 digits with overflow), bipolar error seconds (7 digits plus overflow), bipolar average error rate (7 digits plus overflow), and percent bipolar error-free seconds (7 digits).	**Basic Error Measurements:** Total bit errors (9 digits plus overflow), total parity errors (9 digits plus overflow), total bipolar violations (9 digits plus overflow).
Status and Alarm: All values are seconds during which condition occurred, 7 digits plus overflow: signal loss, frame loss, data sync loss, blue-signal detected, X-bit detected and external-event A, B, C, and D inputs detected.	

Clock: Time-of-day, elapsed time, elapsed time and time remaining in single test, test duration set for single test, elapsed time and time remaining in repeat test, test duration set for repeat test.

Status and Alarm: The following conditions are indicated by front-panel LED indicators, by the front-panel display together with the number of seconds during which each occurred and/or by an audible alarm at the operator's discretion. Another front-panel LED indicates when the transmitter is under remote control. (see Option 02 IEEE-488 Interface, below).

Condition	Display (seconds)	Status LED	History LED	Audible Alarm
Signal Loss	X	X	X	X
Frame Loss	X	X	X	X
Data Sync Loss	X	X	X	
Blue-Signal Detected	X	X	X	X
X-Bit Detected	X	X		
Ac-Power Loss		X	X	
Remote-Control		X		
External A, B, C, D Event Detected	X			
Errors Detected				X

AUDIBLE ALARM: In addition to responding to the status conditions selected by the operator, the audible alarm can be selected to respond to the error rate, with the audio output proportional to the rate of errors counted. Volume is set by a front-panel control.

Status Monitor: A rear-panel 24-pin D connector provides normal and complemented TTL-compatible outputs for the pseudorandom sync pulse (one pulse per sequence), blue-pattern detected, X-bit detected (when framing is used), signal loss, DS3 frame loss, data-sync loss, and status alarm. Four TTL compatible inputs are also provided (A, B, C, D) for counting and display as event seconds.

Signal Monitors: Five separate rear-panel BNC connectors provide output signals behind 75 Ω for recovered clock (±0.5V), bit error (±0.5V, RZ format), bipolar errors (±0.5V, RZ format), parity error (TTL compatible, RZ format), and M-sync (TTL compatible from M1 to M2 in each frame).

Power: ***AC POWER:*** 115V or 220V ±10%, 50 to 60 Hz, 100VA, via a 6-foot detachable power cord (supplied) that connects to a rear-panel receptacle and is stored in the cover when not in use. LOST POWER LED indicator lights following restoration of power after a low-line or power-fail condition; indicator can be reset by front-panel pushbutton. Dc power available, see Option 08.

Mechanical: Portable bench-top blue-painted aluminum case with protective cover. Convenient carrying handle mounted on right side of case. ***DIMENSIONS:*** 6.6 in. high x 13.6 in. wide x 19.82 in. deep overall including cover and handle. ***WEIGHT:*** 21 lbs. net, 26 lbs. shipping.

Accessories Supplied: Ac and dc power cords, protective cover, instruction manual, spare ac fuse, and spare dc fuse.

Option 01 Special Input Characteristics: Binary data and clock input levels, other than +1V for logic-1 and -1V logic-0 into 75 Ω at BNC connectors, can be provided; consult factory.

Option 02 IEEE-488 Interface: For remote control, front-panel LED indicates when receiver is under remote control.

Option 03 RS-232-C Interface: For output to printer, analog modem, or auxiliary channel. Printouts are made at the end of an error-second and at the end of a test. ***END OF ERROR SECOND:*** Real time at the end of the error-second, bit or parity errors accumulated during the error-second, and the event seconds for signal loss, frame loss, data sync loss, blue-signal detected, X-bit detected, and external A, B, C and D inputs. ***END OF TEST:*** Duration of test, time of day at end of test, event seconds of all 9 internal and external events, total errors, total error seconds, average error rate, percent error-free seconds, total dribbling errors, dribbling error rate, and threshold bit or parity error seconds.

Option 08 Dc Power: -21 to -27V or -42 to -56 Vdc, 150VA, office-battery input via a 6-foot detachable power cord (supplied) that connects to a rear-panel receptacle, separately fused.

S5200D-TX Digital Transmission Test Transmitter

OPTIONS for added capability:
- OP-01 Special Output Characteristics
- OP-02 IEEE-488 Interface
- OP-08 Dc Power

S5200D-RX Digital Transmission Test Receiver

OPTIONS for added capability:
- OP-01 Special Input Characteristics
- OP-02 IEEE-488 Interface
- OP-03 RS-232-C Interface
- OP-08 Dc Power

Specifications are subject to change without notice.

tau-tron

Tau-Tron, Inc. 27 Industrial Ave., Chelmsford, MA 01824
(617) ~~256-9013~~ TWX: 710-343-6781
692-5100 In Canada: (613) 692-2536

Form 138-481D

To return a unit for repair:

1. Call the Customer Service Dept., **(617) 256-9013**, for a **Repair Authorization Number.** This will reduce administrative delays and ensure prompt return of your unit.

2. Complete and **attach one of the Repair Tags** below to your unit.

3. **Pack the unit** in the original shipping carton and packaging materials, if available. Otherwise use a double-walled carton (test strength of 350 lb) and shock absorbing material such as bubble wrap to prevent the unit from moving in the carton during transit. Seal with heavy paper tape.

4. **Send to:**

   Tau-Tron
   27 Industrial Ave.
   Chelmsford, MA 01824
   atten: Customer Service

Repair Tag

Repair Authorization Number _____

Model _____ **Serial Number** _____

☐ Warranty repair ☐ Dead on arrival ☐ Repair ☐ Recalibration

Symptoms: _____

_____

Name _____ Title _____

Company _____ Dept./MS _____

Address _____ City _____

State&Zip _____ Phone _____

Form 0163-0281A

Repair Tag

Repair Authorization Number _____

Model _____ **Serial Number** _____

☐ Warranty repair ☐ Dead on arrival ☐ Repair ☐ Recalibration

Symptoms: _____

_____

Name _____ Title _____

Company _____ Dept./MS _____

Address _____ City _____

State&Zip _____ Phone _____

Form 0163-0281A

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